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COWPEAS.

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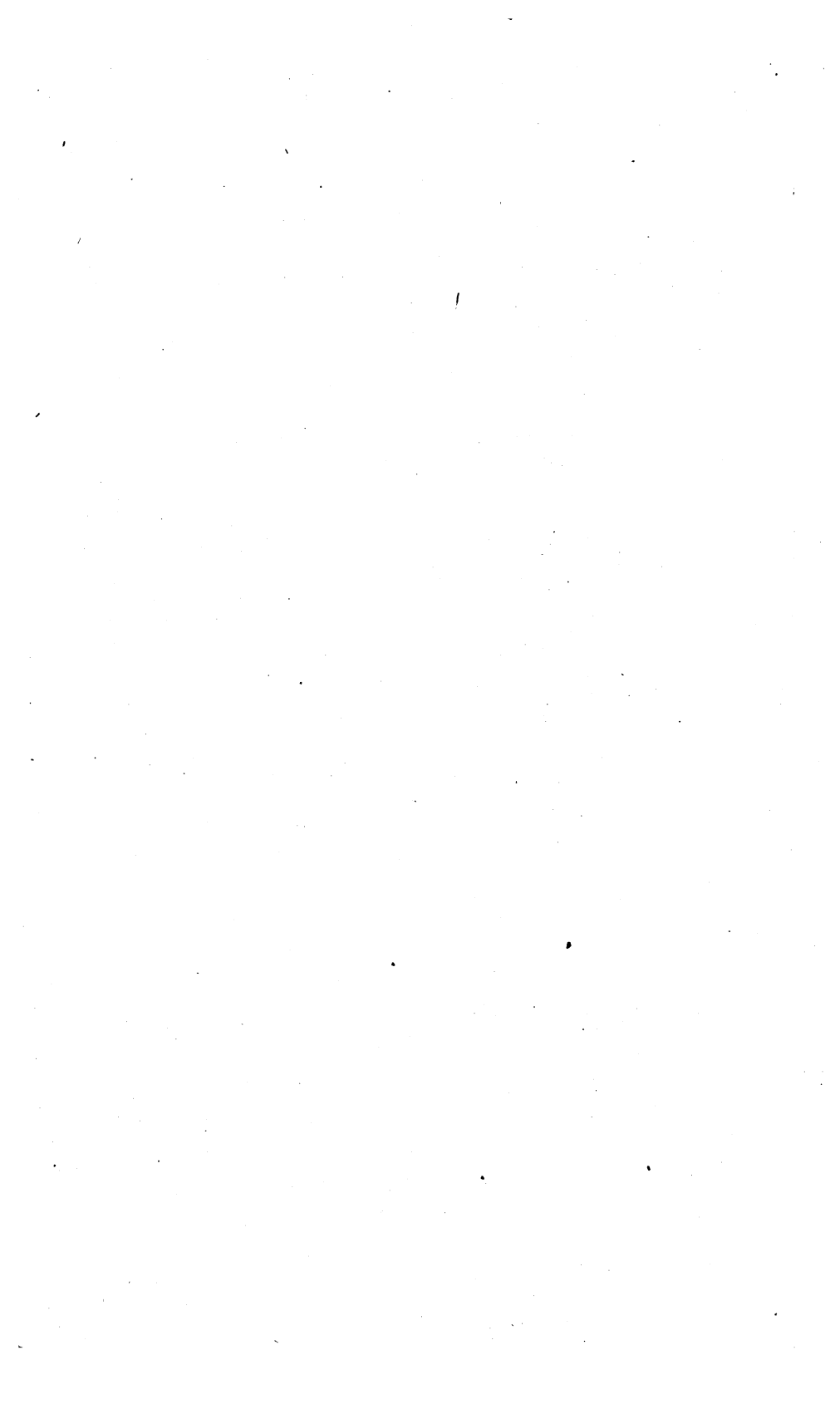
SIR: I have the honor to transmit and to recommend for publication as a Farmers' Bulletin the accompanying manuscript on "Cow-peas," prepared by Mr. H. T. Nielsen, Scientific Assistant in Agronomy in Forage Crop Investigations.

The cowpea is the most valuable legume for the Southern States and its use would be much more extensive were it not for the relatively high price of the seed, most of which is still picked by hand. Particular attention is therefore given to the matter of harvesting seed by machinery now in very successful use in several communities. These methods are so far perfected that the cowpea seed crop should receive much greater attention in favorable localities.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.



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COWPEAS.

INTRODUCTION.

A system of agriculture without the use of a leguminous crop tends to lessen the productivity of the soil and makes necessary large outlays for nitrogenous fertilizers. With a leguminous crop grown at frequent intervals, the productivity may be maintained or even increased. The cowpea (fig. 1) is at the present time, and probably will continue to be, the most valuable legume for the entire cotton belt, and can be depended upon to succeed on practically all types of soils. It has been well said that the cowpea is to the South what red clover is to the North and alfalfa to the West.

It is safe to say that no one thing can add more to the agricultural wealth of the South than the more extensive growing of the cowpea. This will supply the southern markets with much of their hay, which is now shipped in from the North and West. It will tend to increase the production of live stock, which is very essential in securing the maximum returns in any system of agriculture; and it will go far toward keeping the soil in good tilth and maintaining its productivity.

While cowpea culture has greatly increased in late years, this very fact has in part brought about a large increase in the price of seed. The more extensive use of the crop will be seriously retarded until seed becomes more plentiful than at present. Fortunately the development of improved machinery for handling cowpeas makes it certain that this will soon be the case and that the price of seed will be materially reduced without lessening the profit to the grower.

Cowpea seed for planting should be fresh and of good quality; or, if old, should be tested for germination, as seed more than one year old is likely to be very low in vitality. It is practically certain that seed which ripens and is harvested in dry weather is of superior quality. Varieties with hard seeds are injured to a less extent by wet weather at harvest time than those with soft seeds. They also retain their vitality for a longer time and are less subject to the ravages of weevils. The Iron cowpea is the only common variety which has any advantage over other sorts in this respect.

COWPEAS FOR HAY.

Good cowpea hay is fully as valuable a feed, pound for pound, as red clover hay, and very nearly equal in value to alfalfa or to wheat bran. The principal value of this hay lies in its high percentage of digestible protein, which is nearly four times that of timothy hay.



FIG. 1.—Cowpea plant (*Vigna unguiculata*), showing ripe pods.

One reason why cowpeas are not more extensively used as a hay crop is the difficulty often experienced in curing the large growth of succulent vines. Where proper care is taken in curing, especially where sorghum or a similar plant is grown with it in mixture, it is not a difficult matter to make good cowpea hay unless the weather is decidedly unfavorable.

When grown for hay production cowpeas are nearly always broadcasted or put in with a grain drill any time from May 15 to July 15. The quantity of seed used to the acre ranges from one to two bushels, broadcasting requiring from one-fourth to one-third more than is necessary when using a grain drill. The quantity most commonly used and which gives the most general satisfaction when the seed is put in with a grain drill is five pecks to the acre. The use of a grain drill is decidedly superior to broadcasting. Larger hay yields have frequently been secured by planting in rows 24 to 36 inches apart and giving two or three cultivations, the seed required in this way being from two to three pecks per acre. The increased yield of hay due to cultivation is not sufficient to cover the increased cost, especially as rather thick broadcast seeding is equally as effective in destroying weeds as cultivation in rows. The practice of broadcasting on small grain stubble and plowing under the seed is still common; also that of putting in the seed on grain stubble with a disk drill without plowing. Both of these practices are rapidly being replaced by good preparation of the soil before seeding.

As nearly as average conditions will permit, cowpeas for hay should be planted so that they will be at the proper stage for hay making in the latter part of August, in September, or early in October, as the rainfall is likely to be small during that time. With four to six days of dry sunny weather, cowpeas can be cured into hay of excellent quality if they are at the proper stage of maturity when cut.

The proper time to cut cowpeas for hay is when most of the pods are full grown and a considerable number of them are ripe. At this stage none of the best hay varieties have dropped their leaves. Of the large list of cowpea varieties, those with an upright habit of growth which seed fairly well and mature quite uniformly should be chosen for hay. The varieties more commonly used are Whippoorwill, Unknown, New Era, and Iron. These hold their leaves well and stand up much better than most of the other varieties. Such varieties as Black, Red Ripper, and Clay are not desirable for the production of hay, as they run to vine badly and are consequently very hard to cure and handle. The readiness with which the hay can be cured depends largely upon the maturity of the vine and the condition of the weather; hence the advisability of having the harvesting come when the season is most likely to be dry.

An ordinary mower is the most practical machine for cutting cowpeas for hay, and if an erect variety is grown the entire plant can readily be saved. The mowing should begin in the morning, as soon as the dew is off, and may be continued all day if desired, though some advocate cutting only till noon. The vines should be

left in the swath until well wilted on top, but not till the leaves are dry and brittle. They should then be raked into windrows; this may be the same day or the day after mowing. They should be left in the windrows one or two days and then put into small cocks of one or two forkfuls. The cocks should be left till the vines are well cured, from two to five or six days, depending on the conditions which have prevailed during the curing period. A good rule to follow is that peas are ready for stacking or putting into the barn when it is not possible to wring moisture out of the stems by twisting a handful with considerable force.

The hay tedder can be used very advantageously in making cowpea hay. If the growth is very heavy the tedder should be used immediately after mowing, as it will open up the vines so the sun and air can get to them better. It can be used to good advantage on vines in the swath after the top part is wilted, as it opens them up so they will dry out more uniformly. It is also valuable for opening up the windrows a half day or a day before cocking. An ordinary rake can also be used for turning the windrows over. The tedder should never be used except when the vines are either green or damp, so as not to cause the loss of too many leaves.

In case of wet weather setting in shortly after mowing, the best practice is not to touch the vines at all until after the rain. It is a mistake to be in a hurry about handling after wet weather. If the vines are fairly mature before cutting, a wet spell during hay-making, unless prolonged, is not a very serious matter. If, however, the vines are immature when cut, great difficulty is always experienced in curing the hay in unfavorable weather.

Several special devices are more or less used in curing cowpea hay. The most common of these is a pole, usually with crosspieces nailed at right angles, around which the vines are cocked. Triangular pyramids from 2 to 3 feet high, built of poles with crosspieces nailed on to hold them together, are used to a small extent in the same way. The object of these devices is to get air into the vines by keeping them from becoming tightly packed together and to have an air space in the center of the cock. Canvas or other covers, or hay caps, to protect the cocks during rainy weather, also have a limited use. These devices give excellent results in curing cowpeas, but on account of the increased cost and labor they entail are not in general use. A good and comparatively cheap hay cap would find a ready market and could be sold in large numbers. It would be a great help in cowpea hay making.

COWPEAS IN MIXTURES.

While cowpeas can be satisfactorily grown alone for hay, it is a much better practice as a rule to grow them in mixtures. The most widely used crop for this purpose is sorghum. This includes both the sweet sorghums and the kafirs. The sorghum serves to support the cowpea vines, and its use usually results in increasing the yield of hay considerably. An additional important advantage is that the hay is more easily cured, as the sorghum prevents the matting together of the cowpea plants. Corn is also used very extensively in mixture with cowpeas, but only to a small extent for hay purposes. The two are grown together very satisfactorily in cultivated rows. Other crops that have been used to grow in mixture with cowpeas are millet, soy beans, and Johnson grass.

Cowpeas and sorghum.—In the Piedmont region of the South a large percentage of the cowpeas planted for hay is in mixture with sorghum, and the practice should spread rapidly, as this mixed hay is very nearly a complete ration and is relished by all farm stock. The mixture has given excellent satisfaction on the Arlington Experimental Farm, near Washington, D. C. The variety of sweet sorghum most used is the Amber, as it is not as coarse as the others and hence cures more rapidly. The seeding is best done with a grain drill on well-prepared land, the two kinds of seed being well mixed and sown at the same time. The best rate is one bushel of good seed of cowpeas to one-half bushel of sorghum to the acre. If a grain drill is not available for seeding, the cowpea seed should be disked or plowed in, and the sorghum seed should then be sown while the land is rough, and covered with a drag harrow. The Whippoorwill, Iron, Unknown, and Clay cowpeas require about the same time as sorghum to mature and therefore should be used instead of the early varieties. In general, the planting may be done from June 1 to July 15.

Growing cowpeas and sorghum together in cultivated rows gives excellent results. They should be planted together in rows $2\frac{1}{2}$ to $3\frac{1}{2}$ feet apart, three pecks of cowpea seed and about one-third of a bushel of sorghum seed being used to the acre. The Sumac and the Orange varieties are fully as good as the Amber sorghum for this use, as they grow larger and stronger plants. The harvesting is most satisfactorily done with a mower.

Cowpeas and corn.—Cowpeas are most widely used at present for growing with corn. When grown in this way a farmer secures a crop of corn, sufficient cowpea seed for use the next season, and either a hay crop or a certain amount of grazing for his stock. The cowpea is an excellent plant to grow with corn for ensilage, and is being used quite extensively for this purpose on many dairy farms,

especially in the northern part of the cowpea region. When planted in the cornfield it is usually at the last cultivation of that crop. The quantity of seed used to the acre ranges from a half bushel or less to two bushels, depending largely on whether the planting is broadcast or in rows close to the corn. Generally the best results are obtained by the use of about three pecks of seed and planting near the rows of corn, preferably with a corn, cotton, or other planter, immediately after the last cultivation of the corn. Usually the peas are allowed to ripen a fair percentage of pods, which are gathered for next year's seed, and the vines are then pastured.

In the sugar-cane districts of Louisiana and in parts of Mississippi and Alabama the cowpeas are made into hay instead of being pastured after the corn has been gathered. This is a very good practice and is becoming general. The work is very satisfactorily done with a strong wooden-toothed rake, which pulls the vines and leaves them in small bunches for curing. The harvesting is also done with a mower to some extent.

In a few localities, especially in parts of Maryland, corn and cowpeas are sown thickly together for hay with excellent results. The seeding for this purpose is at the rate of one-half to one bushel of corn and one bushel of cowpeas to the acre. The two mature at practically the same time, the yield is large, and the curing is easily done.

Cowpeas and Johnson grass.—Where Johnson grass is not a pest or where it is well established on a field and there is no desire to clean it out, it can very satisfactorily form a part of a mixture with cowpeas. At the Arlington Experimental Farm in 1906 the mixtures of Johnson grass and cowpeas gave the best results both in yield and in the quality of the hay produced. There is no difficulty in killing out Johnson grass north of Tennessee and central Virginia, but south of these States the difficulty increases rapidly.

The mixture should be sown at the rate of one bushel of Johnson grass and one bushel of cowpeas to the acre; if the seeding is done with a grain drill, care must be exercised not to cover the Johnson grass seed too deeply. Where this grass is already established, the land may either be plowed or thoroughly disked in late spring, the treatment depending on the nature of the soil, and then the cowpeas alone should be sown in June. One and a half bushels of cowpea seed to the acre are frequently used, as the Johnson grass makes a more vigorous growth under such circumstances than when coming from seed. This latter practice is common at Augusta, Ga., and gives excellent results. The quality of hay obtained is very good and it is not as coarse as the mixture with sorghum. The fact that Johnson grass often becomes a troublesome weed is the only objection to it in

mixture with cowpeas for hay production. In other respects it is the best plant for this purpose.

Cowpeas and millet.—German millet has often been grown in mixture with cowpeas. As it matures in a relatively short time it is adapted for growing only with the early varieties of cowpeas, such as the New Era, and even with these the yield is rarely increased. The millet aids materially in curing the hay, however, and possibly improves its quality by adding variety. Millet should never be used in mixture with the late and rank-growing cowpeas, as the results obtained are not satisfactory, since in addition to maturing too early the millet is not strong enough to hold up the cowpea vines.

Cowpeas and soy beans.—But little experimenting has been done in growing soy beans and cowpeas together, but the results obtained have been very promising. Only the larger-growing soy beans, such as the Mammoth variety, are suitable for this use. The soy beans are strong enough to assist very materially in holding up the cowpeas, and they also aid effectively in curing the hay. The combination is therefore worthy of much more extended use. The hay of this mixture is an exceedingly rich one, as the composition of both plants is high in protein. Seeding should be at the rate of a bushel of soy beans and a half bushel of cowpeas to the acre.

COWPEAS FOR PASTURE.

The use of cowpeas for pasture is not as a rule the best farm practice, but under certain circumstances it is advisable and fairly profitable. Grazing cultivated lands is likely to render succeeding tillage more difficult on account of the trampling by stock; and, unless care is exercised in pasturing cowpeas, loss of animals by bloating may result, especially in wet weather. However, the small amount of work and the insignificant cash outlay always associated with the grazing of stock commend the practice to the average farmer, and scarcity of labor often makes it necessary to pasture a crop whenever possible. Cowpeas when planted in corn are very commonly used for grazing, especially with hogs.

The best time to begin pasturing cowpeas is when the first pods are ripe. This practice is not generally followed, as at least a part of the seed is saved first. When the peas are grown in cornfields the grazing is deferred until the corn has been gathered.

In a feeding trial at the Alabama Agricultural Experiment Station it was found that pigs fed corn alone gained 0.36 pound daily, while pigs on cowpea pasture and corn gained 0.97 pound daily, consuming 36 per cent less corn for each pound of gain. The returns were \$10.65 for an acre of cowpeas, with corn at 40 cents a bushel and hogs at 3 cents a pound.

The Oklahoma Agricultural Experiment Station reports that cowpeas planted early in July furnished two grazing periods for milk cows before frost in the fall and that the flow of milk was noticeably increased. At the Arkansas Station steers were fattened on cowpea pasture and cotton seed, making an average gain of 2 pounds a day for ninety days. So long as the pea vines were green and considerable seed was available, very little cotton seed was eaten. The cost of each pound of gain was only 2 cents for the cotton seed, thus showing the high value of the cowpea pasture.

FEEDING VALUE OF COWPEAS.

Cowpea hay.—The feeding value of cowpea hay has long been recognized, as it has been used extensively for all kinds of stock in the Southern States. With a fair number of ripe peas in the hay it has been found to be satisfactory when fed alone to stock at work, and can be used very successfully as a maintenance ration for horses, mules, cattle, sheep, and even hogs. The farmers in the sugar-cane districts of Louisiana make a very extensive use of cowpea hay for their work stock, it being practically the only roughage used. It is generally claimed that horses or mules at work stand hot weather better when fed cowpea hay than when fed a grass hay and corn. The difference in the appearance of the animals is also very much in favor of the cowpeas.

In a three months' test at the North Carolina Agricultural Experiment Station the rations fed two high-grade Percheron mares, used as a team and receiving the same care and shelter, differed only in the use of 10 pounds of cowpea hay in one and the same quantity of wheat bran in the other. The horse fed bran just held its own in weight while the one fed cowpea hay gained a little. The cowpea ration was 5 cents cheaper in daily cost.

At the Arkansas Agricultural Experiment Station two three-year-old steers were fattened on cowpea hay and cotton seed in a feeding trial lasting ninety days. The daily ration consisted of 13½ pounds of cotton seed and 20 pounds of pea hay. The average daily gain was 3 pounds for each steer, and the cattle were in excellent condition during the entire trial. The profit realized was \$21.30. The Tennessee Agricultural Experiment Station found that 6 to 10 pounds of cowpea hay could be substituted for 3 to 5 pounds of cotton-seed meal in beef production. This indicates that this hay can be utilized to advantage in place of corn and cotton-seed meal when these feeds are high priced.

In the production of milk and butter, the Tennessee Agricultural Experiment Station reports that 1½ pounds of chopped pea hay is equivalent to a pound of wheat bran, and 3 pounds of chopped pea

hay to a pound of cotton-seed meal. With bran valued at \$20 a ton a yield of $2\frac{1}{2}$ tons of cowpea hay would mean a return of \$40 an acre for the crop, based on its feeding value. Cowpea hay is equally as good as bran for producing a flow of milk.

Cowpea seed.—The seed of cowpeas is rarely obtainable at a low enough price to be used as a feed. Its composition indicates that it is a richer feed than wheat bran. The Alabama Agricultural Experiment Station fed cowpeas to fattening pigs with excellent results. More lean meat was found in the bodies of the pigs fed cowpeas than in those fed corn meal only. A great many people have tried feeding the seed, either whole or in broken pieces, to poultry. Splendid results are obtained, the fowls being kept in good condition and producing a good supply of eggs, even in the winter months. Very good results are also obtained by feeding the hay, as the fowls eat all except the hard, coarse stems.

Cowpea straw.—Now that cowpea seed can be secured by running the vines through a thrashing machine the straw is coming to be quite an important feed. While no authentic data are at hand in regard to this straw, farmers and stable keepers who have used it claim that it is an excellent feed, some even preferring it to ordinary pea-vine hay. There have been no ill effects reported from its use. The straw sells for about the same price as the hay.

GROWING COWPEAS FOR SEED.

The greater agricultural use of cowpeas has been seriously handicapped in late years by the high price of seed. Until the last few years cowpea seed has been almost entirely gathered by hand, though that harvested by machinery makes up an increasing percentage of the commercial seed each year. Cheaper seed will undoubtedly bring about an enormous increase in the culture of the crop.

Cowpeas when grown for seed or for combined seed and hay production are nearly always sown broadcast or with a grain drill. Occasionally fields are planted in rows and cultivated. Experiments generally prove that the largest yields are secured by planting in rows and cultivating, but in many localities this increased yield is not sufficient to offset the additional cost of cultivation.

The planting of cowpeas for seed production should always be thinner than for forage purposes. Figure 2 shows a field of cowpeas of the Whippoorwill variety planted in rows one-fifth rod (about 3 feet 4 inches) apart and cultivated three times, while figure 3 shows a field of the same variety broadcasted thickly. Attention is called to the fair crop of pods and the larger size of the plants in the cultivated area. Figure 4 shows a field of Iron cowpeas planted in rows one-fifth rod apart and cultivated three times. The plants are much

larger than those shown in figure 5, a field of the same variety broadcasted thinly; but the plants in both fields are well podded. When grown in rows 24 to 36 inches apart one peck to a half bushel of good seed per acre is required. When the seed is broadcasted the quantity ranges from 3 to 6 pecks to the acre, depending on the soil, the method of seeding, and the size of seed. Heavy clay or light sandy soils require more seed than loam soils. If sown with a grain drill only about two-thirds as much as for broadcasting is required. Of the smaller seeded varieties, such as the New Era and the Iron, 2 or 3 pecks will give the best results; while of the larger seeded varieties, such as the Black, the Unknown, and the Whippoorwill, the quantities range from 3 pecks to 5 pecks to the acre, a bushel generally being the best amount to use. In most of the cowpea region planting for



FIG. 2.—Field of Whippoorwill cowpeas planted in one-fifth-rod rows and cultivated three times.

seed production should be rather late in the season, since late plantings as a rule give much better seed yields than early plantings. This is not the case, however, in Oklahoma and northern Texas, where early seeding gives the best yields, owing probably to the lighter rainfall. In certain sections near the Gulf, two seed crops in a season may be secured by growing in rows and planting the first very early.

HAND PICKING.

The method of gathering seed by hand is the only one practicable where the peas are planted in corn, which is a very common practice throughout the South. The cowpeas are planted at the last cultivation of the corn and are nearly always ripe before frost. The vines

climb the corn stalks, so most of the pods are well above ground, which greatly facilitates gathering them. They are picked by hand into bags, and later flailed or run through a pod huller. The cost of hand picking ranges from 40 to 75 cents a hundred pounds of pods, or the picker is given one-third to one-half of the total quantity gathered. This method of harvesting naturally makes the price of seed high. Fields grown to cowpeas alone for seed production are often hand picked. The yield of seed in such cases is as a rule much larger, and a larger number of pods can be picked in a day than when grown with corn. The Blackeye and similar varieties grown for table use are usually picked by hand.

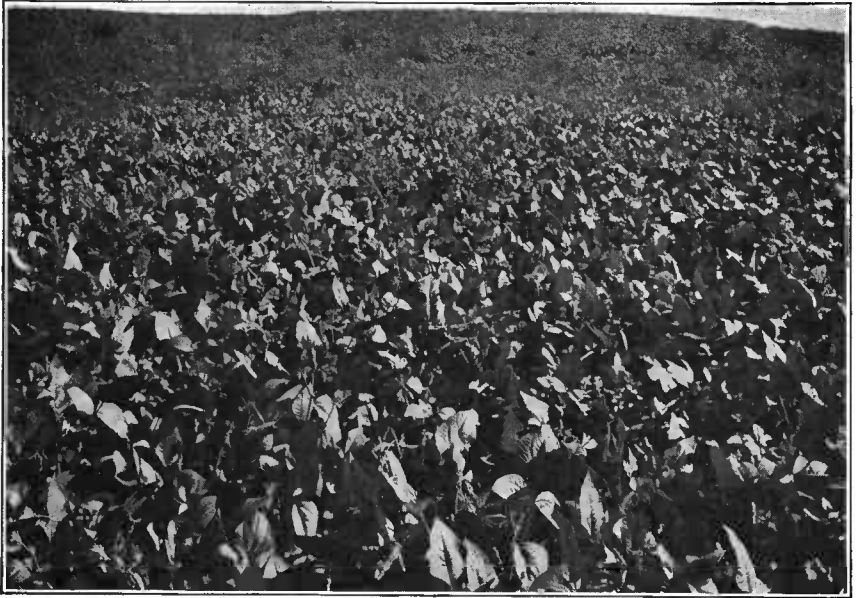


FIG. 3.—Field of Whlppoorwill cowpeas broadcasted thickly.

MACHINE PICKING.

The scarcity of seed and the difficulty of securing labor have resulted in the invention of several so-called pea pickers. These machines are intended to gather the pods from the vines in the field. The peas must be planted in rows for the most successful operation of a pea picker, and the entire plant must be ripe and dry before the machine will do satisfactory work. Two of these pickers are constructed on much the same principle, that of a winged drum revolving rapidly over a stationary moderately sharp edge. The pods are thus knocked back upon a platform and then elevated into a receiving box or bag. A third machine differs from the foregoing in that the picking apparatus is very much in the nature of a flailing operation,

the cylinder consisting of four arms made up of pieces of gas pipe. This revolves rapidly and knocks the pods back into the gathering



FIG. 4.—Field of Iron cowpeas planted in one-fifth-rod rows and cultivated three times.

box. A fourth machine is a harvester and thrasher combined. In this, the vines are cut with an ordinary mowing arrangement and



FIG. 5.—Field of Iron cowpeas broadcasted thinly.

passed directly to the thrashing part of the machine, which is essentially the same as that of any thrasher. This last-mentioned

machine is very satisfactory for harvesting perfectly ripe peas, since it very nearly completes the operation. For harvesting varieties grown for table use, such as the Blackeye, the Lady, and other white peas, it may find considerable demand.

MOWING AND THRASHING.

Cowpeas for seed production are quite satisfactorily harvested with a mower. A bunching attachment (fig. 6) has been used with excellent results. This gets the vines out of the way of the team, thus avoiding considerable loss of peas through trampling and crushing by the mower wheels. It also leaves the vines in a more desirable shape for curing, they being rolled into small windrows. The self-rake reaper (fig. 7) is a very satisfactory machine for mowing cowpeas for seed, accomplishing even better results than the buncher on a mower, as the vines are left in bunches of very convenient size for curing and handling.

The bean harvester has been given careful trial in harvesting cowpeas for seed production, but it is

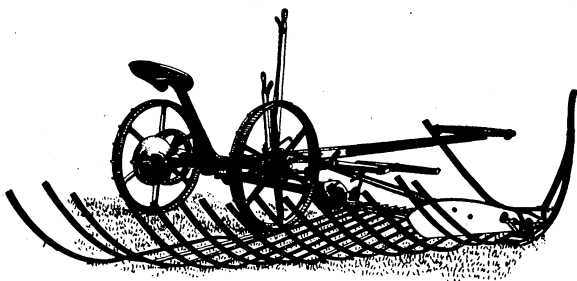


FIG. 6.—A bunching attachment on an ordinary mower.

not very satisfactory. Viny peas catch on parts of the machine and drag badly. There is also likely to be much soil worked into the vines, making the further handling difficult and disagreeable. The accompanying illustration (fig. 8) shows a bean harvester at work.

For seed production cowpeas should be allowed to mature a greater percentage of pods than when cut for hay. Half or more should be ripe before mowing, even at the expense of losing a part of the foliage. The vines should then be allowed to cure and become thoroughly dry, after which the thrashing may be done. The curing and drying may be done in the swath, cock, stack, or barn, as desired, weather conditions largely determining the method to be pursued. The hay or straw is of better quality if the curing and drying are done in the stack or barn, though, of course, the amount of work required is greater. It is a common belief that weevils do much less damage to seeds in the pods than to the thrashed seeds. On this account some growers store their crop and thrash it late in the winter or early in the spring. However, the unthrashed material requires much space for storage, and there is no effective

way of combating the insects, while in clean stored seed all insect life is readily destroyed by treatment with carbon bisulphid.^a

Cowpeas may be thrashed with an ordinary grain thrasher. In this case the riddles are adjusted for cowpeas and satisfactory screens are provided. The most essential point in thrashing cowpeas is to maintain a low and even speed of the cylinder, 300 to 400 revolutions per minute, while the rest of the machine should be adjusted to run at least as fast as for thrashing wheat or oats. Some operators prefer to have a greater clearance between the cylinder and concave spikes than for grain thrashing, while others do not think this an advantage. While expert operators sometimes do very satisfactory work with an ordinary grain separator, there are three

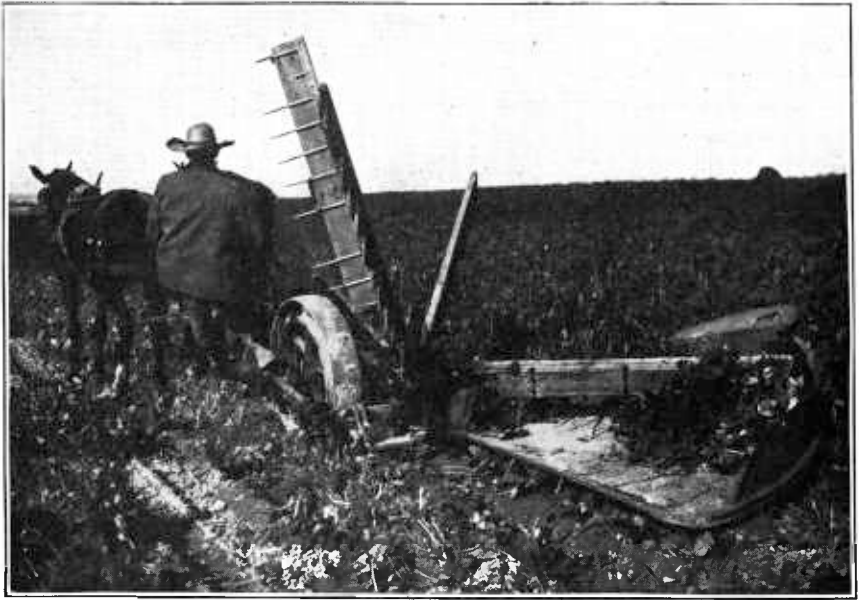


FIG. 7.—Harvesting cowpeas for seed with a self-rake reaper.

important difficulties encountered: (1) Too many of the pods pass through with the straw unopened; (2) the machine is easily choked by the tangled vines wrapping around the cylinder; and (3) the percentage of cracked peas is usually large.

To overcome these difficulties several modifications of thrashing machines have been devised so as to adapt them for handling cowpeas. One modification which has been adopted in several different machines is the use of two cylinders. These cylinders are adjusted

^a For destroying weevils or preventing damage by them, see article on "Insects Injurious to Beans and Peas," in the Yearbook of the Department of Agriculture for 1898.

to run at different speeds, the front one slowly, about 300 revolutions per minute, and the rear one more rapidly, about 450 revolutions per minute. Apparently the only advantage gained by two cylinders over one is that a smaller percentage of the unopened pods pass through with the straw. The use of two cylinders, however, results in a somewhat larger percentage of cracked peas.

A second modification which has been applied both to machines with one cylinder and those with two is to sharpen the spikes on the concaves or on both the concaves and cylinders. This sharpening means bringing the face of the spike to as nearly a sharp edge as can be done by ordinary blacksmithing. The beneficial effect of sharpening the spikes is very marked, as the vines pass through much more readily, there is little tendency to wrap around the cylinder, the amount of power required is very materially reduced, and the percentage of cracked peas is decidedly smaller. The straw is also chopped so it is in fine condition for feeding. A one-cylinder machine with the spikes sharpened does



FIG. 8.—Harvesting cowpeas for seed with a bean harvester.

very satisfactory work except that a small percentage of the pods may pass through in the straw unopened, while by the use of a two-cylinder machine practically all the peas are secured.

In a third device all the spikes in both cylinder and concaves are sharpened, and there is a minimum of clearance. The concaves are arranged in two sets, one of two rows and the other of three. The two-row set is at the front of the cylinder on a plane with the shaft; the other is below the cylinder and at the back of it about 120° from the first. There is a perforated web under the cylinder which is hinged at the three-row set of concaves and has the front part attached to the shakers so that it is worked up and down by their back-

ward and forward motion. When the vines come through the first concaves they drop on the web, rest momentarily, and are then picked up by the cylinder again and taken through the second concaves. This momentary rest results in the rearrangement of the straw, so that it virtually amounts to passing through a second cylinder, as in the two-cylinder machines. A perforated feeding table is used to get loose peas to the separating surface without passing through the cylinder. This machine is by far the most satisfactory pea thrasher yet devised. The number of cracked peas is very small; the vines are chopped as fine as if they had been through a cutting box, and all the peas are gotten out of the pods, while the material which can be run through in a given time is the maximum for present-day machines and the power required the minimum.

It is very essential in thrashing cowpeas that there be sufficient power to give a uniform speed to the separator. It is also highly desirable that the cylinder be kept uniformly full in order to get the best results, as running empty means an increase in the number of cracked peas.

The price of cowpea thrashers now on the market ranges from \$300 to \$600, exclusive of the engine. If the peas are stacked or put into a barn so they need not be thrashed immediately, one machine will be sufficient for 2,000 acres, as the crop from 20 acres can readily be handled in one day. As a rule only a moderate acreage of cowpeas for seed should be grown by any one farmer, as unfavorable weather may cause great difficulty at harvest time. It is very desirable to have enough cowpeas for seed grown in a community to justify the local ownership of a thrashing machine.

COWPEAS FOR SOIL IMPROVEMENT.

The beneficial results of growing cowpeas are due largely to the ability of the plants, like those of alfalfa and red clover, to take nitrogen from the air by means of the bacteria which live in the nodules on the roots. Cowpeas also improve markedly the physical condition of the soil. This, taken in connection with their ability to produce a crop quickly on even the poorer soils, makes the cowpea particularly valuable both as a catch crop and in regular rotations when utilized either for hay or seed production.

At the present time the most popular rotation for the entire South is one which allows the largest possible area to be planted in cotton each year. A system of cropping which is in general use is three years in cotton, the fourth year in corn and cowpeas, and then three years in cotton again. This system allows three-fourths of the farm to be in cotton each year, and is applicable to all of the better agricultural land. On the poorer soils of the cotton belt it is likely that

better results would be secured by growing cotton only two years and corn and cowpeas the third year. This would leave two-thirds of the farm for cotton each year, and would undoubtedly be an excellent system of cropping. The Alabama Agricultural Experiment Station reports an increase in yield in one case of 696 pounds of seed cotton to the acre, or 83 per cent, due to plowing under a crop of cowpea vines on land which had been in cotton the previous season. The Arkansas Agricultural Experiment Station secured an increase in yield of 59 per cent where a crop of cowpeas had been grazed the preceding year.

Practically the same plan of rotation is followed in the sugar-cane districts of Louisiana. Three crops of cane are taken off the land, and the fourth year it is planted to cowpeas or to corn and cowpeas. The work stock are fed almost exclusively on pea-vine hay or are grazed on cowpeas in the cornfield after the corn has been gathered. This rotation gives excellent results in the succeeding crops of cane.

A rotation of wheat or oats and cowpeas is giving excellent results in parts of Missouri, Arkansas, and Tennessee. Cowpeas are sown on the land immediately after the removal of the grain crop and are utilized for hay or seed or for pasture. Grain is sown again in the fall, thus making two crops a year from the same land. In many instances landowners in Arkansas and Missouri have allowed tenants the use of land free of charge for producing a crop of cowpeas, stipulating, however, that the land must be well prepared. When the soil is given good preparation before sowing the cowpeas, it is not necessary to plow in the autumn for the grain. The fall preparation usually consists of disking the cowpea stubble and sowing the grain with a drill. Occasionally the seeding is done with a disk drill without any preliminary preparation. The increase in yield of wheat due to the cowpeas is generally given as from 3 to 5 bushels per acre. At the Missouri Agricultural Experiment Station, an increase in yield of 63 per cent with oats and 49 per cent with wheat following cowpeas as a catch crop was secured. The Arkansas Agricultural Experiment Station reports as the average of a four years' test on wheat an increase of 25 per cent from plowing under cowpea stubble the first fall, 39 per cent from plowing under cowpea vines, and 42 per cent where cowpeas were grown each year as a catch crop between the wheat crops, only the stubble of the peas being plowed under. The increased yield in the latter case amounted to 70 per cent in the fourth season, the yields having gradually increased from year to year, in addition to producing a fair quantity of very nutritious hay each season.

On farms where more or less live stock is produced the following three-year rotation is very popular and is a good one: First year,

cotton; second year, corn with cowpeas at last cultivation; third year, winter oats or wheat, with a catch crop of cowpeas for hay or seed after the grain has been removed.

A few striking results due to the growing of cowpeas are here noted. The Alabama Agricultural Experiment Station reports a yield of oats following cowpea vines plowed under 247 per cent larger than where German millet was plowed under. The Arkansas station reports an increase in yield of 63 per cent on corn where cowpeas were grazed the season before. The Missouri station increased the yield of corn 79 per cent by growing cowpeas on the land for two years before planting the corn. In yield of hay the Arkansas station secured an increase of 116 per cent on oats following cowpeas grazed the year before. The Alabama station increased the yield of sorghum hay 2.01 tons, or 55 per cent, by plowing under cowpea stubble on land where sorghum was grown the previous year.

These and many similar experiments conclusively prove that it is much more economical to use cowpeas for hay or seed production in rotation with other farm crops than to use them for green manuring. It is only in special cases that it is advisable to utilize cowpeas as a green manure. On very poor sandy land or on stiff, heavy clay soils in bad mechanical condition a crop of cowpeas plowed under will give markedly beneficial results. Cowpeas give very good satisfaction as a cover crop in orchards, for which they find a limited use. In case of bad weather setting in at harvest time it may be desirable to utilize the crop for green manure, or to pasture it if the land is of such a nature as not to be seriously injured by the trampling of stock.

VARIETIES OF COWPEAS.

There are about 50 varieties of cowpeas known, but only a few of the best of these are extensively cultivated. The varieties differ in such characters as habit, size, earliness, prolificness, disease resistance, and especially in the color of the seeds, which are either entirely white, red, buff, black, or blue, or variously blotched or speckled. The varieties are all very constant in their seed characters. The variation in vines, however, is very marked, being influenced by the time of planting, the nature of the season, and the locality where grown. Early planting or a wet season usually results in a large growth of vines. Natural crosses between the varieties occur under favoring conditions, but they are far from common. The use to be made of the crop by the grower should determine largely which variety to select.

For table use the varieties with white or nearly white seeds are preferred, as they make a more attractive dish. The habit of growth of the table peas is of little direct concern, and, as a matter of fact, none of them is very satisfactory for forage purposes. The prin-

cipal varieties are the Blackeye, of which there are several strains, the Browneye, the Lady, and the Cream. These are more properly considered vegetables. Several of the colored-seeded varieties are also used as table peas.

For forage purposes the most desirable varieties are those which have a fairly upright habit, grow to large size, hold their leaves well, and produce an abundance of pods. Descriptions of the most important varieties follow. Of the numerous remaining varieties none is grown to a very large extent, and most of them are distinctly inferior to those described here.

Whippoorwill.—The Whippoorwill variety is known under several other names; such as Running Speckled, Bunch Speckled, and Shinney. It may be considered the standard of all field cowpeas. It is suitable either for grain or hay production, or both. It makes a vigorous growth, is fairly erect, and still produces a large amount of vine. It can readily be handled by machinery, which is bringing it more and more into prominence. The seed is mottled chocolate on a buff or reddish ground color.

Unknown, or Wonderful.—The Unknown, or Wonderful, cowpea is another field variety which is grown to a large extent. It is the largest growing and most vigorous of the cowpeas, but is late in maturing, it being difficult sometimes to secure seed of it as far north as Washington, D. C. The principal objection to this pea is its light seeding. It is nearly as erect as the Whippoorwill variety; hence, it is quite readily handled by machinery either for grain or hay production. The seed is large in size and of a very light clay color.

New Era.—The New Era is the smallest seeded of the cowpeas that have found a wide use. The seed is bluish in color, owing to the innumerable minute blue specks on a gray ground. The New Era is the most nearly erect of any of the varieties, rarely having any prostrate branches. It usually produces a heavy crop of seed and matures in from seventy-five to ninety days. It is one of the earliest of the cowpeas and is the most easily handled by machinery. The small seed is not usually considered an undesirable character, as a smaller quantity is required for seeding than is the case with other varieties.

Groit.—The variety known as the Groit has been much confused with the New Era cowpea. In habit the two are much alike, but the Groit is a little superior, as it makes a larger growth and fruits more heavily. The seed is quite similar to that of the New Era, but has chocolate mottlings in addition to the blue specks. It is quite certainly a hybrid between the New Era and the Whippoorwill varieties.

Iron.—The Iron variety is coming rapidly into prominence. In its habit it is only slightly different from the Unknown, though it is not quite as vigorous or as large. It is earlier than the Unknown and the seed, though nearly the same color, is much smaller, being but very little larger than that of the New Era. The characteristic of the Iron cowpea which has been instrumental in bringing it into prominence is its resistance to wilt and to root-knot caused by eel worms. It is the only one of the cowpeas which has been found to resist these diseases. Where they are prevalent in the soil, the Iron cowpea is the only variety which can be successfully grown, and since the diseases are spreading the distribution of the Iron cowpea is also increasing. Regardless of its resistance to these diseases it is a valuable variety under nearly all conditions, being vigorous, prolific, and quite erect. The seed is hard and retains its vitality better than that of most varieties. It will lie in the ground through the winter and germinate the next spring. This variety and the Unknown hold their leaves better than any others.

Clay.—The Clay cowpea is more variable in its habit than any of the foregoing varieties. It is the most pronounced trailer of any of the peas grown quite largely, and is consequently in very slight favor where the pea crop is handled by machinery. The plants are very vigorous but low growing, and they usually seed sparingly. Since seed is such an important item at the present time, a variety which has but poor fruiting qualities is not apt to remain popular, even though it may be harvested readily by machinery. The seed is of the same color as that of the Unknown and the Iron, but is intermediate in size and flatter and longer.

Black.—The Black cowpea is used to a considerable extent in the sandy coastal plain soils of Virginia and North Carolina. On heavy clay land this variety makes a very heavy growth of vine, but produces very little seed, while on the sandy lands it grows more bushy and fruits quite heavily. It also finds some demand in the sugar-cane section of Louisiana, where it is grown with corn in rotation with sugar cane. Where other varieties thrive the Black is not a favorite. The seeds are quite large and entirely black.

Taylor.—The variety called Taylor has larger seeds than any other cowpea. The seeds have nearly the same markings as those of the New Era, though the ground color is somewhat lighter. The Taylor cowpea has met with considerable favor in Maryland and Delaware, where it is erroneously called the Gray Crowder, but outside of this region does not seem to be a very valuable variety. In most cases it is too much of a trailer to be desirable. It also has a tendency to drop its leaves earlier than any of the other varieties except the Black.

Red Ripper.—The Red Ripper is a valuable pea, as it makes nearly as large a growth as the Unknown, or Wonderful, and is excellent for growing in corn. It is very late, usually maturing but a small number of peas at Washington, D. C. It is difficult to procure seed of it in quantity on account of its light yield. The seed is dark red and about the same size as that of the Whippoorwill variety.

SUMMARY.

(1) The cowpea is the best legume for the entire cotton belt, and can be profitably grown much farther north. It is especially suitable for combined hay and seed production or for hay alone.

(2) To make good cowpea hay requires careful handling of the crop. The plant should have made its growth and have at least the first pods ripe when the mowing is done. Uniformity in maturing is essential in getting the best results. The use of a tedder is very helpful. The serious loss of leaves can be avoided by not handling the hay when the leaves are dry and brittle. The curing is best done in small cocks, and the hay is ready for the stack or barn when no moisture can be wrung from the stem by twisting it with considerable force.

(3) Cowpeas for hay production are very advantageously grown in mixture with sorghum, Johnson grass, or soy beans. The yield is thus increased, the quality improved, and the curing more easily done. Cowpeas give very good results when grown with sorghum in cultivated rows and are very commonly planted in corn and used for grazing or ensilage.

(4) Pasturing cowpeas is not the most economical practice, but it is frequently resorted to because of the small expense it entails. Cowpeas are especially suitable for grazing hogs.

(5) Cowpea hay is very nutritious. It is nearly equal to wheat bran as part of a ration. It is satisfactory for work stock and for beef or milk production, and it gives good results when fed to poultry. The grain is a rich feed, excellent for poultry but little used for other feeding. Cowpea straw is an excellent roughage and nearly as valuable as the hay.

(6) Cheaper cowpea seed will result in the much more extensive growing of the crop. Harvesting for seed can be done most cheaply by the use of machinery. The crop should be cut with a mower or self-rake reaper when half or more of the pods are ripe. When thoroughly dry the thrashing may be done with an ordinary grain separator with some modifications, with a two-cylinder cowpea thrasher, or with a one-cylinder special machine which has all the thrashing spikes sharpened in addition to having ingenious devices which make it the most satisfactory thrasher for handling cowpeas.

(7) Cowpeas add nitrogen to the soil and improve its mechanical condition. They are most profitably grown in rotation with other crops. The following rotations are good ones:

(a) Cotton, three years; corn and cowpeas fourth year; and then cotton again. This is all right on the better soils of the South, but the cotton should be planted only two years in succession on the poorer soils.

(b) Wheat or oats with cowpeas each season after the removal of the grain crop, the land being seeded to grain again in the fall, making two crops a year from the same land.

(c) Cotton, first year; corn and cowpeas, second year; winter oats or wheat followed by cowpeas as a catch crop, third year; and then cotton again.

(8) The most valuable varieties are the Whippoorwill, the Unknown or Wonderful, the New Era, and the Iron for field purposes; and the Blackeye for table use.

(9) The Iron cowpea is practically immune to the two serious diseases, wilt and root-knot, which attack the other varieties more or less. It alone should therefore be grown wherever these diseases are prevalent.

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